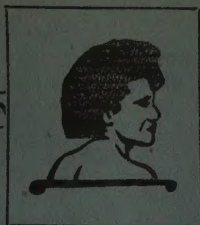


VOL. 18 NO. 2



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So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues published and those which are not now available is given for reference. Attention is especially directed to Volume 7 which had only one part:—

<i>Vol.</i>		<i>Vol.</i>	
1.	3 numbers, 1928.	10.	4 numbers, 1939 (none of Nos. 2 and 4).
2.	4 " 1929.	11.	4 " 1940 (none).
3.	3 " 1930 (none).	12.	4 " 1941 (none of Nos. 1 and 2).
4.	4 " 1931.	13.	4 " 1942.
5.	2 " 1932 (none of No. 2).	14.	4 " 1943.
6.	2 " 1933.	15.	4 " 1944.
7.	1 " 1934.	16.	4 " 1945.
8.	4 " 1935-37 (none of No. 4).	17.	4 " 1946 (none of No. 1).
9.	4 " 1938 (none of Nos. 2, 3 and 4).		

ISSUES OF THE AGRICULTURAL CIRCULAR.

NUMBERS and year of issue of the *Agricultural Circular* :—

Vol. 1, 1920, 12 numbers.	Vol. 4, 1923, 1 number.
2, 1921, 5 "	5, 1924-5, 2 numbers.
3, 1922, 4 "	

As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, No. 1.

ANNUAL BULLETINS.

THE Annual Bulletin of Divisional Reports ran from 1931 to 1938 and was then discontinued.

OLD ISSUES OF AGRICULTURAL BULLETINS.

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- No. 1. Sisal Hemp in Fiji, 1911.
 3. Rhinoceros Beetle in Samoa, 1912.
 4. The Banana in Fiji, 1912.
 5. Scale Insect on Bananas, 1913.
 6. Lemon Grass, 1913.
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 8. Coconut Experiments, 1915.
 9. Soils of Fiji—I, 1916.
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 13. Sea Island Cotton, 1920.
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 18. Control of Coconut Spike Moth, 1935.

The following are available to the public at the prices shown—

- No. 21. Biological Control of the Rhinoceros Beetle, 1941. Price 1s.
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 22. An introduction to the Mosquitoes of Fiji, 1943. Price 1s.
 23. Insect Pests in Fiji, 1946. Price 1s.
 Gardening Notes, Insect Pest Control and Plant Diseases, 1945. Price 1s.

Applications should be made to the Librarian, Department of Agriculture, Suva, Fiji.

—EDITOR.

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EDITORIAL

THE COPRA MARKET

The recent decision by the Ministry of Food to raise the price of copra to its present level of £41 13s. 6d. (Fiji currency) aroused considerable discussion amongst copra producers as to the desirability of a long term contract with the Ministry in order to secure the advantages of knowing for some years ahead the gross income likely to be available for estate maintenance and rehabilitation. To many of those with recollections of disastrous prices during the 'thirties the present price no doubt appears very attractive; it is well above the cost of production by any normal standard and it should provide the means of building up a reserve with which to carry out the repair or replacement of drying and storage equipment and other plantation facilities. In the case of many of the older plantations, moreover, a further moiety of this reserve should be brought to capital account to offset the declining yield of palms which have reached or passed the age of maximum productivity; even if the planter has insufficient confidence in the future of the industry to undertake actual replanting, he must still make provision for the contraction in productive value of his plantation.

It is to be hoped therefore that estate owners will be able, and willing, to take advantage of the present period of comparatively high prices to so rehabilitate their affairs that they can in due course face a period of declining prices with the confidence that only efficient equipment and estate organization can give. It must

be admitted, however, that the apparently wide margin between cost of production and return to the producer may prove to be largely illusory: there is no inexhaustable pool of labour from which recruits either for increased production or rehabilitation can be drawn while most materials necessary for the reconstruction or extension of plantation equipment are costly and in short supply, and the supply position is not likely to show rapid improvement. There are, in fact, the elements of inflation present, and it is perhaps for this reason that so many estate producers are distrustful of the present situation and are inclined to welcome the suggestion of a long term contract for the purchase of copra with its attendant security, even at the probable sacrifice of some part at least of the present price.

Just how much of the present price could be sacrificed for such a contract without putting producers at a considerable disadvantage in terms of prices on the "free" market depends on the market trend during the term of such a contract, and at this stage it becomes apparent that any decision on a long term contract is itself a gamble. It is only certain that if a contract were accepted, and the "free" price remained substantially higher during the greater part of the term of the contract, there would be dissatisfaction and resentment. There is no certain guide to the trend of prices over the next three or four years and it is possible only to draw attention to the cautiously expressed opinions of those who should be in the best position to judge.

When, in 1945, a committee was set up to investigate certain problems of the copra industry, a preliminary step was the circulation of an inquiry to a number of overseas authorities, including oil seeds brokers and crushers, concerning *inter alia* the future trend of demand for copra. One question asked was: "What are the prospects for copra for the next 10 years?" To this question only two replies were received—one that the market would remain favourable to producers for the next five years (i.e. until 1950), and the other that prices would keep up for two years (i.e. until 1947) followed by a decline, with a suggested range of from £22 to £15 sterling, c.i.f. London, for the next 10 years. To a similar question "will there be overproduction of fats and oils and a fall in price of copra?" five answers were received, all of them cautious, to the effect that prices would remain good "for some time." Later pronouncements have been published, such as the following extract from the Report (1) of the Special Meeting (of the Food and Agriculture Organization of the United Nations) on Urgent Food Problems, held at Washington in May, 1946:—

"Current indications are that world supplies of fats and oils will be no greater in 1946-47 than in 1945-46. Increases in production of supplies for export are in prospect for some areas, and demobilization is continuing to result in some savings, but these are about offset by decreases in other areas and by the fact that 600 thousand metric tons of the fats and oils consumed in 1945 were drawn from the stocks in the United Kingdom and the United States. However an increase in supplies of fats and oils from the liberated areas in the Pacific and Far East should develop in 1947, although not materially so until the last half."

In addressing a meeting of the Imperial Institute Consultative Committee on Oils and Oilseeds on the 17th May, 1946, Mr. Frank E. Fehr, C.B.E., remarked:—

"We must expect an increased consumption of oils and fats the world over as the demand for soap will increase, also the demand for margarine, as vitaminized margarine tends more and more to

replace butter, but it should be possible to extend the production of oilseeds to meet this demand . . . During the war fresh sources of supply were created; these will tend to continue to produce, and we shall have pre-war production steadily restored."

Mr. Fehr also says:—

"As traders, our one fear is that restrictions and pool purchasing will tend to restrain that free movement of commodities which is essential to obtain maximum supplies." (2)

Further there is the following lengthy extract from the F.A.O.'s Report (3) of the Preparatory Commission on World Food Proposals. While this gives a general picture of the world supply position there is no attempt to forecast the trend of the market, and the statement in paragraph 44 should be noted that "The net long-term effect of these wartime influences is difficult to assess."

"41. The Commission's examination of the critical situation of oilseeds, oils and fats has been greatly helped by the fact that the Fats, Oils and Feeds Committee of the International Emergency Food Council has been meeting at the same time to consider measures for dealing with the present world shortage. The Commission's conclusions and recommendations, which are largely based on the work of this Committee and of the I.E.F.C. secretariat, are set out below.

42. In the five years before the war, world production of all fats and oils averaged about 20 million metric tons in terms of oil equivalent. Vegetable oils made up three-fifths, and animal fats and marine oils the remaining two-fifths of the total. World exports in the five years 1935-39 averaged six million metric tons in terms of oil equivalent. Vegetable oils constituted three-quarters of the total.

43. Between the two wars, increased production was accompanied by expanding consumption at declining prices. In the early thirties primary producers had to bear the brunt of the serious decline in prices. From 1932 onwards, tariff

duties, preferences, import quotas and restrictions tended to change the direction of international trade, and prices of oils and fats within different countries became, to some extent, independent.

44. Oils and fats were in ample supply until 1940. There was a steady increase in the production of coconut and oil-palm products specially on plantations, and world production of whale oil, mainly in the Antarctic, from 1943 onwards was more than double the 1925-29 level. During the war, shipping difficulties reduced exports and led to some shift in tropical and sub-tropical countries from export crops to rice and cereal crops for local consumption. During the Japanese occupation soya bean production in Manchuria decreased and oil-palm plantations in Malaya and in the Netherland East Indies were neglected or abandoned. There has been little inducement for planting coconut and other palms during the last seven years. Rehabilitation of oils and fat production in the Far East may take a long time. Elsewhere in the world, particularly in the United States and South America, apart from a decrease in Argentine linseed acreage, there has been a rapid increase in production under the stimulus of war-time demand and high prices. In Europe, including U.K. and U.S.S.R., there has been a sharp decline in animal fat production. The net long-term effect of these wartime influences is difficult to assess.

45. The shortage of oils and fats at the present time is acute. World production in 1946 was just over 16 million metric tons in terms of oil equivalent or about 75 per cent of the pre-war level. The resumption of copra production in South-east Asia, increased oilseed planting in the Western Hemisphere and a slight recovery of fat production in Europe is expected in 1947. In Greece and other Mediterranean countries, olive oil production has not yet recovered from the effects of the war. In 1946, quantities available for export were less than three million metric tons compared with over six million metric tons before the war. It is estimated that to restore the pre-war

per head fat utilization, total imports of more than seven and a half million metric tons would be necessary.

46. The obstacles to rehabilitation are many and complex. General world food shortage makes it necessary to concentrate efforts on increased production of bread grains and rice. Lack of consumer goods to act as incentives, shortage of machinery and transport equipment and obsolescence of processing facilities are also serious handicaps which are accentuated by shortage of foreign exchange. To overcome these difficulties a more aggressive attack on the problem is needed involving a concerted plan of mutual aid between governments. The Commission welcomes the decision of the I.E.F.C. to undertake a more detailed review of the position, and to formulate practical proposals for intergovernmental action within the next two months.

47. As regards the long-term problem with which this Commission is concerned, we believe that in the case of oils and fats, there is a very strong case for providing an assured market for producers and for giving them some security against the risk of a violent fall of prices resulting from any business depression or temporary over-production. Among the plans to be considered are national and international price support measures, or long-term contracts between exporting and importing countries negotiated in conformity with multilateral principles. Measures of this kind may be specially suitable in the case of olive oil, palm oil and coconut oil, which have a long production period and depend on sales spread over many years to earn a return on the capital invested. Intergovernmental consultation on planting policies is needed in the case of oil-bearing crops.

48. Lastly the Commission recommend that the valuable research work and intergovernmental consultation now being carried out through the medium of the I.E.F.C. should be continued as a permanent feature of F.A.O.'s activities. Review of planting and production programmes and study of the probable trend of demand in this highly complex group

of related commodities will supply the essential background to help governments in framing concerted policies designed to bring about orderly expansion of world production of oils and fats."

And finally there are the following extracts from the report⁽⁴⁾ of the Commission sent to East Africa to explore the possibility of the mechanized production of groundnuts; the first is from the introduction to the report, the second from the summary and conclusions.

"Detailed examination of the probable trends of world supply and demand makes it clear that, in the absence of special measures on a larger scale than any at present in preparation, oilseeds, oils and fats are likely to fall short of the world's requirements for a long period, extending possibly beyond 1960. During that period, unless there is widespread unemployment and a catastrophic recession in international trade, it is most improbable that the market value of groundnuts will fall below a price which would ensure a satisfactory margin over the probable production costs under this scheme."

"The world is to-day suffering from a critical shortage of oils and fats, the annual shortfall in the case of Britain

alone amounting to the equivalent of 1½ million tons of groundnuts. Although the present acute phase may have passed in four or five years, it is the view of those best able to judge that there will be a continuing world shortage for a long time, say, for the next 10 to 20 years."

From these pronouncements it may be judged that it is indeed difficult to decide on a fair basis for a long term contract. Security and stability are most desirable, but it seems impossible to forecast what hypothetical price, in terms of margin under the "free" market price, might have to be paid for such a contract. —C.H.

REFERENCES.

- (1) 1946. "Food and Agriculture Organization of the United Nations". Report of the Special Meeting on Urgent Food Problems. Washington D.C. June 6.
- (2) Fehr, Frank E., C.B.E., 1946. "A Review of the Present World Position of the Supply and Demand for Oils and Oilseeds with Special Reference to the Colonial Empire." Bull. of the Imperial Institute, Vol. XLIV, No. 3, 183-187.
- (3) 1947. "Food and Agriculture Organization of the United Nations". Report of the Preparatory Commission on World Food Proposals. H.M. Stationery Office, Cmd. 7031, January.
- (4) 1947. "A Plan for the Mechanised Production of Groundnuts in East and Central Africa". H.M. Stationery Office, Cmd. 7030, February.

OVERSEAS VISITORS

Recently the following visitors have spent varying periods with officers of the Department, in the course of their local investigations.

During June Dr. W. E. H. Stanner, M.A., Ph.D., an Australian anthropologist, was in Fiji on behalf of the Institute of Pacific Relations in connexion with his study of reconstruction problems in the Pacific. He was particularly interested in the trends of agricultural production in the Colony during recent years. Dr. Stanner has since been appointed by the Secretary of State for the Colonies as Director of an East African Institute of Social Research.

Mr. D. Waterhouse, M.Sc., of the Council of Scientific and Industrial Research, Australia, was a through passenger on the s.s. *Rabaul* early in July and spent two days

pursuing entomological inquiries covering the control of noxious weeds and insect pests—fruit and house-fly parasites and Buffalo fly.

From New Zealand recently came Professor G. S. Peren, Principal of Massey Agricultural College on the course of a visit to Samoa, Rarotonga and Tonga. His object was to study general agricultural conditions in the island territories so that the interests of local students can be better catered for.

Mr. C. F. Hickling, Fisheries Adviser to the Secretary of State for the Colonies arrived in Fiji on 11th July and spent several weeks investigating Fisheries problems in the Colony and in the territories of the Western Pacific High Commission.

—B.E.V.P.

WEED CONTROL STUDIES IN FIJI

By B. E. V. PARHAM

I. METHODS AND MATERIALS

The general position regarding the distribution and status of weeds in the Colony has been described in the Report⁽¹⁾ of the Committee appointed in 1944 to make a survey and to submit recommendations for the better control of weeds. Amongst the recommendations made was the following:—

“The Department of Agriculture should be enabled to undertake investigations into methods of pasture and grazing improvement.”

The present note is the first of a series intended to record the progress made with these investigations; and deals, in the first instance, with the methods and materials which are being employed.

For references to previous work on weed control readers should consult Appendix II of the Report. This work has been concerned mainly with various aspects of biological, mechanical and chemical control of weeds as follows.

Biological Control.—To date only two weeds (*Lantana*¹ and *Koster's Curse*²) have responded to biological control by means of insect parasites introduced for the purpose. In 1910, Jepson introduced the Mexican seed-destroying fly³ for control of *Lantana*; and in 1922 Simmonds⁽²⁾ introduced two butterflies,⁴ the larvæ of which destroy the flowers. As the results obtained with these insects were not fully effective, Simmonds⁽³⁾ in 1928 introduced the lace-bug⁵ from Hawaii where it was doing good work by defoliating the plants and preventing seed production. This insect has become well established and has done useful work in checking the growth and spread of this weed.

In 1928, Taylor⁽⁴⁾ reported on a search in Trinidad for an insect parasite for the control of *Koster's curse* which at that time was a serious weed of pastures in the wet districts. He recommended the introduction of a West Indian thrips⁶ to Fiji, and this was accomplished in 1930 as recorded by Simmonds⁽⁵⁾. This insect is now found

almost everywhere in Viti Levu and has been liberated in Vanua Levu, Taveuni, Kadavu and other islands of the Colony as well as in the British Solomon Islands Protectorate. It has been the principal factor in the suppression of this weed in Fiji.

Other attempts at biological control have not been so successful. Two parasites, a weevil⁷ and a moth⁸ were introduced in 1935 and 1938 for the control of nut grass⁹; but neither of them has been effective and it is considered that they are of no importance for this purpose.

The possibilities of finding insect parasites for such weeds as *Prickly solanum*¹⁰, *Hibiscus burr*¹¹, and false vervain¹² (locally known as blue rat tail) have been investigated without positive results. Inquiries are now being made in Australia regarding the prospects of introducing either the seed fly or the stem-boring beetle¹³ for the control of *Noogoora Burr*¹⁴.

The limitations of biological control of weeds which have been adequately described by Millar⁽⁶⁾ and Simmonds⁽⁷⁾ are summarized as follows in the Report of the Committee (⁽¹⁾, page II).

- “(a) the weed must in its native habitat be kept under control by the parasite that will thrive under the conditions of the country to which it is to be introduced;
- (b) the weed should not be closely related to plants of economic importance otherwise there is a danger that the

¹ *Lantana aculeata* L.

² *Clidemia hirta* Don.

³ *Agromyza lantanae* Frogg.

⁴ *Thecla echion* L. and *T. agla* Hew.

⁵ *Teleonemia scrupulosa* Stal (= *T. lantanae* Dist.).

⁶ *Liothrips urichi* Karney.

⁷ *Athesaepula cyperi* Marsh.

⁸ *Bactra truculentia* Meyr.

⁹ *Cyperus rotundus* L.

¹⁰ *Solanum torum* Sw.

¹¹ *Urena lobata* Benth.

¹² *Slachytarpheta urticifolia* (Salisb.) Sims.

¹³ *Euaresia aequalis* Loew.

¹⁴ *Xanthium italicum* Morretti.

introduced insect will turn to these; and

- (c) the parasite should first be studied in the native habitat of the weed and then introduced and exhaustively studied under strict quarantine in the new environment before liberation."

Millar adds the following important factors which must be considered.

- "(1) that the habits of the host and those of the insect should synchronize, for example, the flowering period must be correlated with the egg-laying period of seed-infesting insects;
- (2) the possibility that the weed-controlling insect may be influenced by indigenous parasites, or by those parasites imported and established against some related noxious insect; and
- (3) the effective control of a weed must be followed up by establishment of pasture or other useful plant covering, as otherwise useless plants, perhaps more difficult to control, may take possession." (l.c. p. 154.)

Mechanical Control, involving the various methods readily available to the landholder, as pulling by hand, cutting and mowing, digging out and burning has been generally practiced in the Colony for many years. Previous records, dealing mainly with the comparative efficacy and costs of these methods have been published by Barnes^(*) and by the present writer^(*) and are also referred to in the 1945 Report (1, pages 4 and 11).

There are also a few references to local trials with weed burners and flame-throwers but little evidence of any useful results.

Chemical Control.—Chemical control of weeds locally has until recently received little attention and has been confined to occasional trials with sodium chlorate, arsenic pentoxide, dieselene oil, salt and a few proprietary weedkillers. The results of such work have been briefly recorded by Barnes and the present writer. The general use of poisonous, corrosive or inflammable chemicals has been considered undesirable under local conditions for fear of accidents

to unskilled labourers and to animals. During the past two years, however, the development of selective weedicides of the plant hormone type has greatly enhanced the prospects of direct control of weeds and has stimulated local investigations on a more extensive scale. The scope of these studies may be indicated briefly.

Research Projects 1946-47.—In August 1946 the Research Committee of the Department of Agriculture approved the following projects for immediate action.

Weedicide Trials were given priority in the programme and were designed to determine the effect of available weedkillers on the following major weed species: Solanum, Hibiscus burr, Noogoora burr, Tobacco weed¹, Water Hyacinth², Broom Weed³, Mint Weed⁴, Koster's curse and nutgrass. It was clear that the observations would also be extended to cover a number of other weed species normally associated with the principal species. Details of the layout of plots, the concentrations of weedicide and quantity used will be given in subsequent notes, each weed or group of weeds being dealt with separately. In practice it proved necessary to vary the methods and to date trials have been carried out in localities involving 82 weed species of both wet and dry zones in Viti Levu.

Other research projects dealing with methods of pasture and grazing improvement were instituted. These comprised records of green and dry weight yields of nine grasses and six legumes; observations on the comparative palatability of introduced legumes and local grasses; botanical composition of pastures in the wet and dry zones, covering changes in the associations of weed and fodder species under controlled rotational grazing; observations on the regeneration of weed infested pastures following closure to stock. The progress of these studies will be reported upon later.

Selective Weedicides.—As many of the local weeds infest pastures and grazing land, the recent developments with selective

¹ *Elephantopus mollis* HBK.

² *Eichornia crassipes* Solms.

³ *Sida acuta* Burm. f.

⁴ *Hyptis pectinata* (L.) Poit.

weedkillers which destroy broad leaved plants without damaging grasses, were studied and steps were taken to obtain supplies for trial under local conditions.

Also, early in 1946, Mr. B. Chalmers (then serving with the Royal Air Force) made inquiries in England which resulted in a consignment of Agroxone being supplied by Messrs. Plant Protection Ltd. Messrs. Pest Control Ltd. of Harston, Cambridge, also subsequently forwarded sample quantities of other materials—Denoc, Denocate, Phenoxyl and Denoxylon—which will be described below.

In addition orders were placed in New Zealand and Australia for other materials as Dinoc, Weedone and Weedex, the first manufactured by Messrs. Timbrol Pty Ltd., Rhodes, New South Wales, and the last two by the American Paint Company and distributed by Messrs. Ivon Watkins Ltd., of New Plymouth, New Zealand. Brief notes may be given on the above materials all of which have been under trial during recent months.

Dinoc.—(D.N.O.C., D.N.C. or SINOX) is the sodium salt of dinitro-orthocresol—and is used in solution (0.3–1 per cent). The efficacy of this solution as a weed-killer is increased by the addition of a small quantity of sulphate of ammonia (one pound to 100 gallons spray with maximum efficacy when five to ten pounds are used). The material is available as a paste (30 per cent sodium dinitro-o-cresylate) and has been used at the rate of $\frac{3}{4}$ gallon per 100 gallons of aqueous spray per acre for control of broad-leaved weeds in corn fields.

Denoc.—Is stated by the manufacturers to "contain an activated dinitro-ortho-cresol and substances of high fertilizing value". The recommended solution for general use is 1 : 66 sprayed at the rate of 100 gallons per acre if the temperature is moderate or at 80 gallons per acre if weather is hot.

Denocate.—Denocate is listed as "a fortified product containing activated dinitro-ortho-cresol together with growth promoting substances".

Denoxylon.—Denoxylon from the same source "combines the properties of acti-

vated dinitro-ortho-cresol with a weed-killer of the plant hormone type" and is stated "to kill a much larger range of weeds than any other weedkiller yet discovered."

All three sprays are poisonous to animals and humans.

Blackman⁽¹⁰⁾ has recorded that 2 : 4 dichloro-phenoxyacetic acid and 2-methyl-4-chloro-phenoxyacetic acid are selectively toxic at exceedingly small concentrations to annual weeds in cereals and maize. The range of weeds is less than with the dinitro-ortho-cresol (D.N.C.) compounds but these substances have been outstanding for white charlock and other weeds in England. These materials are exceptional in that absorption can take place both through the shoots and roots of plants and they can be applied either as sprays or dusts. Several proprietary lines have now been placed on the market.

Agroxone.—Agroxone is a 10 per cent solution of methoxone (M.C.P.A. or 2-methyl-4-chloro-phenoxyacetic acid) prepared by Messrs. Pest Control Ltd., Harston, Cambridge, England, the recommended usage being one gallon liquid agroxone to 99 gallons water (i.e. 0.1 per cent solution of M.C.P.A.) applied at the rate of 100 gallons per acre for control of broad-leaved weeds in cereal crops.

Phenoxyl.—Supplied by the same firm is stated to be "a selective weedkiller of the plant hormone type, non-corrosive to metal and harmless to rubber—non-inflammable. The best results are obtained by using when weeds are 2-3 inches high—the action is gradual, at least 14 days before full effect is visible." Phenoxyl dust is also available.

Weedone.—Is a 9.6 per cent solution of the Ethyl ester of 2-4: dichloro-phenoxyacetic acid (D.C.P.A.) also known as Tufor D. It is available in 1, 4 or 44 gallon drums and the standard solution is 1 : 100 applied at the rate of 160 gallons per acre for pasture weed control and for weeds in early growth.

For bushy weeds a strength of 1 : 60 applied at 160 gallons per acre is recommended.

Dust Weedone.—(0.5–5 per cent) is applied at the rate of 20–40 pounds per acre.

Weedex.—Is a non-selective weedkiller which is stated to kill all weeds when used in a 1 : 30 solution at the rate of 160 gallons per acre.

At an early stage it was proved that combinations of M.C.P.A. and D.N.C. weedicides gave solutions of extremely greater toxicity to plant tissues than did either material when used alone. Local experiences with these mixtures will be described in subsequent notes. Generally speaking the D.N.C. solutions are spectacular but frequently not permanently effective; where as the Tufor D and methoxone products are very slow in action but very much more permanent in effect. D.N.C. materials defoliate many local weeds but regrowth occurs in woody plants and care has to be exercised in the proportionate amount of this material used in combined sprays. The dinitro sprays also burn although they do not kill grasses. To date the most effective single sprays used have been those containing 2, 4-D esters. No injury to livestock in treated fields has been recorded.

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II. ERADICATION OF WATER HYACINTH AND OTHER AQUATIC WEEDS.

The present report is the first of a series dealing with weed control in Fiji. It records the recent work carried out to date on the control and eradication of water hyacinth and associated aquatic weeds in the Colony and summarises available information under the following headings:—

1. Historical summary.
2. Species dealt with and their status as weeds.
3. Experimental work.
4. Recommendations.

1. HISTORICAL SUMMARY (1905–47).

Water hyacinth, which Greenwood⁽²⁾ states was introduced about 1905, was one of the first plants to be recognized as a noxious weed in the Colony and was proclaimed as such by Order in Council on 11th January, 1923. By 1925, the weed was reported by D'Espeissis⁽¹⁾ as "Infesting the lower reaches of several of the rivers where it becomes entangled in the screws of launches and blocks traffic. A fruitless

effort made some years earlier in the Rewa district had resulted in the weed being spread more extensively, in the endeavour to destroy it, when it was torn from the banks and towed outside the mouth of the river, the rising tide taking much of it back again."

D'Espeissis also reported that various means had been tried to destroy the plant in the water, mainly by spraying with poisonous solutions such as sodium arsenate or copper sulphate. These gave promising indications at first but proved incapable of killing the plant completely. The floating tops wilted but the submerged roots remained active and grew again. He recommended that wherever practicable the plant should be dragged out of the water and left high and dry on the banks where it would be eaten by cattle or perish. He urged the necessity for action to prevent the weed spreading to rice fields in the Colony.

It would appear that when the "Diseases of Plants Ordinance, 1913" was replaced

by the "Noxious Weeds and Diseases of Plants Ordinance, 1930", this plant, along with others, was omitted from the schedule of proclaimed noxious weeds and could not therefore be dealt with under regulations. It has spread to many parts of the Colony and is now well established in the Rewa and Navua districts and is common also in pools in the Waidina valley and has been recorded in fresh and brackish water at Rarawai (Ba), Nadi and Sigatoka.

2. THE SPECIES DEALT WITH AND THEIR STATUS AS WEEDS.

Water hyacinth¹ is propagated vegetatively with the greatest of ease and is capable of growth in situations varying from deep river channels to damp hollows in fields, to drains or other places even where surface water is periodically absent. It flourishes in back waters, lagoons, drains and shallow muddy pools where it forms dense masses of vegetation often extending above the level of the water to a height of three feet. The plant is the pioneer species in many streams and is frequently associated with extensive mats of para grass, willow primrose and "wa-kumala". Waterways are thus blocked by an intricately interwoven mass of vegetation partly floating and partly anchored, stretching from bank to bank. Small pieces floating in the rivers become stranded in shallows, on snags or on sand banks and quickly grow into extensive patches often several acres in extent. Not only do these infestations interfere with river transport (launches, punts and boats) but in many districts impede the movement of water in main channels and in subsidiary drains to such an extent that the drainage of large areas of cultivation in neighbouring fields is seriously affected. Road drains in some places are heavily infested and rice fields may be invaded. The plant is tolerant of brackish water and grows in tidal waterways.

The other plants dealt with in this note are very similar in their method of propagation and habit to water hyacinth. They have the same distribution range although with one exception they are not generally so aggressive in waterways as in shallow swamps, drains and rice fields. The exception is the Arrowhead or water chestnut²

which generally occurs in shallow parts of the main rivers. This plant is an erect herb up to four feet high, its roots are embedded in the mud and its propagation is mainly by means of the corms and root processes which multiply rapidly and grow freely in suitable aquatic situations.

The small hyacinth-like Pickerel weed³ has become widely spread in drains and rice fields where it is particularly troublesome. It occurs throughout the Navua district, in all parts of the lower Rewa and in rice fields between Samabula and Suva Point. Its habit and method of spread are the same as those of water hyacinth.

The water kumala⁴ is a creeping herb usually abundant in drains, lagoons and streams. It roots in the mud of banks and spreads far and wide—the long branches floating on the surface.

The Willow primrose⁵ is a widespread weed of damp pastures, rice fields and drains. Two species have been recorded locally—both are semi shrubs capable of living in submerged land on account of the breathing root processes of aerenchyma tissue.

An important associated plant is para grass which grows strongly on the banks of streams and ditches: but which, where water hyacinth is present, also extends into midstream and helps to anchor the floating and semi detached clumps of the latter plant.

Of the above listed plants, only water hyacinth is locally regarded as a serious weed. Owing to its more robust and persistent habit, its rapid spread and ability to become established in a wide range of aquatic and semi-aquatic situations it has long been listed as a noxious weed in many countries.

In 1944^(*) the Noxious Weeds Committee recommended that this species be declared a secondary noxious weed in the Colony, that is to say, a weed the eradication of which by the responsible landholder will be subject to an inspector's order and an

¹ *Eichornia crassipes* Solus.

² *Sagittaria Sagittifolia* L.

³ *Monochoria hastefolia* L.

⁴ *Ipomoea aquatica* Forsk.

⁵ *Jussieuia suffruticosa* L., *J. repens* L.

offence committed only by neglect to comply with the terms of such order. The plant has yet to be so proclaimed.

3. EXPERIMENTAL WORK.

Reference has been made above to earlier trials with weedicides which proved ineffective and also to mechanical eradication methods which resulted in the more extensive spread of the weed (loc. cit 1). Details of this work are not available. Up to the year 1946, however, control work has been undertaken by the Colonial Sugar Refining Company in an effort to reduce infestations in water-ways throughout sugar districts especially of the lower Rewa. The River Board also provided funds for the purpose. The method employed has been to pull up the plants by hand and stack them on the banks or tow them down to salt water. Contracts were arranged and the work could rarely be adequately performed, although there is no doubt but that many major infestations were greatly reduced and the danger of further spread lessened. On some streams labour patrols were employed throughout the year in order to keep streams and drainage channels clear of the weed. Costs were high and recent estimates by competent field officers set these at approximately £100 per acre for one clearing. In some recorded cases owing to the depth of the water and mud and the density of growth, actual costs were considerably higher and in such cases regrowth was usually inevitable and rapid.

In July 1946, as a result of the recommendations of the Weeds Committee, experimental control of this weed was included in the research projects of the Department of Agriculture. The results of these trials are briefly recorded below.

Trial No. 13 was carried out at Naduruloulou on 3rd October, 1946, using two concentrations each of the selective weedicides Agroxone (10 per cent solution of 2-methyl-4-chlorophenoxy acetic acid—M.C.P.A.) and Dinoc (30 per cent solution Sodium dinitro-o-cresylate-DNC.) The concentrations employed were approximately 0.4 per cent and 0.2 per cent M.C.P.A. and D.C.N. respectively; and the rate of application (coverage) was set at 100 gallons per acre. The cost for materials would be £6

and £3 per acre in the case of Agroxone and 48s. and 24s. per acre for Dinoc.

The area used was an unbroken mass of floating water hyacinth with some para grass occupying a back water of the Rewa river which had been cleared some two years previously by hand but which had completely filled up again by regrowth of the weed. A series of eight plots were marked out each plot covering 100 square links = 1/100 acre and two replications of each of the four treatments applied at random. The results recorded on 25th October (i.e. 22 days after treatment) may be tabulated.

Treatment.	Per cent plants destroyed.	
	Plot A.	Plot B.
Agroxone (4%) ..	90	90
Agroxone (2%) ..	60	80
Dinoc (4%) ..	40	20
Dinoc (2%) ..	30	20

The first records were taken on 10th October (i.e. seven days after treatment) at which time the effects of Dinoc were apparently marked. Many of the plants in these plots subsequently recovered. The area was flooded on 18th October when the plants killed by the weedicides were carried away leaving open water. Para grass was not at all affected.

Trial No. 14 was carried out on a mixed stand of water hyacinth and arrowhead growing in shallow water at Drekenikelo, Naduruloulou. In this case Agroxone (4 per cent) only was used and resulted in the complete destruction of both plants.

Trial No. 20 was carried out near Nadali on 19th November, 1946. One half of a major infestation of the weed growing in a back water was sprayed with Agroxone (2 per cent). On this occasion six gallons of solution were used to spray 250 square yards of very heavy growth. The results were recorded as 90 per cent effective, only a few small plants which were sheltered underneath and therefore received no spray, survived.

The actual cost of this work was 4s. 3½d (equivalent to £4 3s. 6d. per acre) for labour and materials.

Trial No. 44. In April 1947, it was decided to carry out an extensive field trial at Qaraniki Creek between Visama and

Natogadravu in South Tailevu, in order to establish the actual cost of eradication. The site comprised some 154 chains of the stream which varied in width from seven yards to 33 yards and was heavily infested with water hyacinth, wakumala and para grass. The estimated cost of clearing 80 chains of this stream by hand had been placed at £150 equal to approximately £100 per acre. On this occasion the proprietary emulsion known as Weedone (9.6 per cent 2:4: dichlorophenoxy-acetic acid) was employed at a strength of 1.5 per cent (0.15 per cent D.C.P.A.) sprayed on with the aid of knapsack sprayers, coverage being limited to a thorough wetting of the plants.

The operations may be summarized—

Total length of stream dealt with ..	154 chains
Area of water-way	10.6 acres
Area of weed sprayed (approximate) ..	3.2 acres
Weedone (total quantity)	13.7 gallons
Total spray used	950 "
Coverage per acre (approximate) ..	.300 "
Time taken (all operations)	12 days
Cost per acre (heavy weed infested) ..	£13 13s. 4d.
Cost per acre (over all)	£4 2s. 1½d.

(Weedone actual cost landed in Fiji at the time was £92 per 44 gallons drum, £2 per gallon approximately. More recent quotations indicate a reduction to 25s. per gallon approximately landed in Suva.—Ed.)

Details of the costs are as follows:—

Total project (154 chains = 10.6 acres) with 3.2 acres of water hyacinth.

(1) Labour—	£	s.	d.
Supervision—12 days at 8s. 6d. ..	5	2	0
Spraying and general—			
12 units at 5s. 8d.	3	8	0
30 units at 5s. 2d.	7	12	6
	16	2	6
(2) Material—			
Weedone—13.7 gallons at £2 ..	27	8	0
Total cost	43	10	6
Average cost per acre	13	13	4

Under conditions of the experiment labour was employed on measuring and pegging areas—this work being included in above costs.

For purposes of comparison the following details are given for 80 chains of heavily infested waterway containing approximately 1.5 acres of the weed the estimate for clearing which by usual manual labour was £150 (= £100 per acre of weed):—

(1) Labour—	£	s.	d.
Supervision—8 days at 8s. 6d. ..	3	7	0
Spraying and general—			
8 units at 5s. 8d. per day	2	5	4
16 units at 5s. 2d. per day	4	2	8
	9	15	0
(2) Materials—			
Weedone—6 gallons at £2 per gallon ..	12	0	0
Total cost	21	15	0
Cost per acre	14	0	0

Incidental costs including transport, boat hire and depreciation on spraying equipment, etc., may be estimated at not more than £2 per acre at any time.

These results were very satisfactory—water hyacinth and "wa-kumala" being completely destroyed leaving extensive areas of open water with an occasional plant of water hyacinth surviving in sheltered sites. These were subsequently dealt with on 6th May, 1946, by spot spraying, when half a gallon of solution was used at a total cost of £1 4s. 0d.

The results of this trial are impressive as regards both the ease and the low cost of treatment and also the efficiency of the weedicide. It is considered that the cost of this trial may be further reduced by using a lower concentration.

Trial No. 45. To establish the efficiency of Weedone for the control of the lesser hyacinth or Pickerel weed, a test plot was laid down in a rice field at Vatuwaqa on 6th May, 1947. A close growth of the weed was sprayed with the 0.15 per cent D.C.P.A. solution and a complete control obtained.

Other trials at Naduruloulou, using combined solutions (Agroxone three per cent and Dinoc one per cent) for the control of this weed and willow primrose were entirely satisfactory when applied at a coverage rate of 80 gallons per acre (two gallons per 60 yards of drain). A similar solution was used to destroy these weeds in growing rice—the latter being in no way affected by the treatment.

5. RECOMMENDATIONS.

The practical aspects of the work done to date are evident in the field and the efficacy of hormone products for the

control of water hyacinth, Pickerel weed, Wakumala or Kankun, and willow primrose is established. The most effective of these materials available to date appear to be Weedone and Phenoxyl; Agroxone is highly effective but it is inclined to run off the glabrous foliage of these plants. Mixed with small quantities of D.N.C. compounds its effect is enhanced. While lower concentrations have proved reasonably effective it is recommended that solutions of 0.15 per cent are most suitable. These may be prepared by using $1\frac{1}{2}$ gallons of solution (Agroxone, Weedone or Phenoxyl) per 100 gallons of water. Spraying should be carried out in fine weather and all accessible leaves wetted. Coverage rate varies according to the size and density of the weed growth—small plants may be thoroughly wetted with applications of 80–120 gallons per acre whereas large plants may require up to 250–300 gallons per acre.

The action of these weedicides is usually delayed but in the case of aquatic weeds is

visible within a day or two after application. Treated areas should be inspected between two and three weeks after spraying and any surviving plants sprayed. The aim should be complete eradication in each site, as a few plants, however small, will rapidly reinfest the area. Expenditure on partial destruction of water hyacinth is uneconomic as within a year the work has to be done again. With the early proclamation of this plant as a noxious weed the co-operation of land holders can be obtained and a thorough campaign organized throughout the principal areas. The practical elimination of this plant from the waterways of the Colony would appear to be no longer a serious annual problem.

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GRAIN SORGHUM

In 1945 at the suggestion of the Agricultural Officer Western (Mr. D. A. Donald) the Department of Agriculture introduced seed of five good varieties of grain sorghum which is a crop commonly grown in the dry zone by Indian farmers for food. It is a useful substitute for rice—being pounded and mixed with sharps for making "roti": it is an excellent poultry grain.

Seed of these varieties, viz., Hegari white, Hegari red, Kilo and Milo was advertised recently through the local press and over the radio, in order to encourage the cultivation of this crop which is fairly drought resistant and matures in about $3\frac{1}{2}$ months. In Queensland, yields of up to 120 bushels were harvested and yields of 90 bushels per acre are frequently obtained. The new dwarf varieties specially suitable and most extensively grown were Kilo, Wheatland Milo and Hegari.

Supplies of seed have now been produced on Departmental stations and as many farmers may be glad to make use of the seed available, small quantities can be obtained free of charge to approved individuals on application to district Agricultural Officers.

POPULATION OF FIJI

The following table shows the population as ascertained at the Census of 2nd October, 1946:—

Europeans	4,594
Part-Europeans	6,129
Fijians	118,083
Polynesians	3,717
Melanesians	
Micronesians	
Indians	120,414
Rotumans	3,313
Chinese	2,874
Others	514
	<hr/> 259,638

CITRUS

As the result of an application made by the Department of Agriculture, Fiji, the International Marketing Division of New Zealand agreed, late in March, to pay higher prices for citrus fruits exported from the Colony.

The price of oranges and mandarins was increased from 13s. to 15s. a case f.o.b. and the price of grapefruit from 13s. to 16s. a case f.o.b.

FIVE YEARS OF PADI PRODUCTION IN THE NORTHERN DIVISION

By L. W. HARWOOD AND S. RAM JAN

This account of five years of padi production in the Northern Division* has been prepared from the records collected by the previous Agricultural Officer Northern (M. D. French-Mullen) and the writers; and deals only with the areas cultivated by small holders who are not cane growers.

The peasant farmer within 20 miles of Labasa, is still in the main, a subsistence farmer, but in such districts as Macuata, Sasa, Dreketi, Lekutu, Bua, and Nadoqo he produces padi as a cash crop, the requirements of the Labasa and other local markets being obtained from these areas. As population increased and the demand for land became more acute Indians have taken up land in all parts of the dry zone of Vanua Levu, and in recent years have spread to the wet zone. Owing to the distance from markets some farmers have become dependent entirely on this crop for their revenue.

LAND TENURE.

An examination of Table 1 shows that many farmers cultivate annual tenancies. Rents vary from 10s. to £1 per acre; and in many cases agistment fees of 4s. and 1s. per head per annum for cattle or horses and goats respectively are charged. Such systems of tenure have been the cause of poor farming methods. Farmers, owing to their insecurity of tenure have been reluctant to build proper bunds, dig drains, construct sea walls, or in short effect any improvements which would be to the advantage of the landlord. Unsatisfactory terms of land tenure have also been the cause of farmers moving from settlement to settlement in search of better conditions.

TABLE 1—LAND TENURE (ACRES).

Province.	Freehold.	Leases		Tenure	
		Native	Crown	5 yrs.	Annual
Macuata and Bua ..	19.0	994	715	193	1166
Cakaudrove ..	2.3	352.3	...	...	80.8
Total ..	21.3	1346.3	715	193	1246.8

VARIETIES.

The following varieties were grown during the period viz: Motka-Tibble, Japni, and Golka, Pahila patna and pichli patna, Lautoka, Karia, China patna, New Guinea, Motmuria, Sonacalif, B.G. 75, B.G. 79, Ramcajara, Demarara, Creole, D116, Basmatia, Baramasia, Jhinwa, Jadhan, Chetua and Lakrahawa. The most important of these varieties are described below.

Motka.—Once the only important variety in this division, it is very susceptible to rice yellows and for this reason has decreased in popularity appreciably in recent years. This variety is late planted, has a short heavy grain and is favoured by Indian farmers only because of its good milling qualities.

Lautoka (= *Bandala*).—An upland variety, does well on poor soils and is invariably broadcasted, it is an early cropper, fair yielder and appears resistant to disease.

Patnas (*Pahila and Pichli*).—These are semi-upland varieties, early maturing and fair yielders. These may be broadcast or transplanted, the latter method being preferable. Patnas are greatly favoured by farmers because of their early maturity and superior eating qualities. These varieties mature in four to four and a half months.

China Patna.—This variety has a long grain of medium width and gives good yields. It is particularly popular in the province of Bua, because it does not lodge.

B.G. 75.—This was introduced to the division by the Department of Agriculture. This variety has become very popular, particularly in the Dreketi district. It is known locally as *Sarea* or *Suva* and is highly regarded by farmers for its yielding qualities, milling and cooking qualities. B.G. 75 does well on a variety of soils and so far has not been badly affected by rice yellows.

*Islands of Vanua Levu and Taveuni.—Ed.

New Guinea.—In two years "New Guinea" variety has come to be one of the most popular varieties. It has a long thick grain, may be grown on a variety of soils, yields heavily, has a strong stem and does not lodge readily. Indications are that this will soon be the most popular variety in the division.

PLANTING PROGRAMME.

The following programme may be regarded as being standard for the division. Farmers endeavour to have their planting completed by the end of January.

October—*Pahila patna* (dibbled or broadcast), *New Guinea* (dibbled), *Sonacalif* (dibbled), *Lautoka* (broadcast).

November—as for October with the addition of *Karia* which is dibbled.

December—*B.G. 75*, *New Guinea*, *Ramcajara*, and *China patna* all transplanted.

January—as for December with the addition of *Motka* (transplanted).

February—*Motka* (transplanted).

TABLE II—PADI VARIETIES IN MACUATA.

Variety.	1941-42.		1942-43.		1943-44.		1944-45.		1945-46.	
	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.
Motka ..	1,326	71	1,687	72	1,948	68	1,530	62	1,314	48
Patnas ..	240	13	290	12	286	10	403	16	482	18
Lautoka	171	9	208	9	253	9	207	9	179	7
Karia ..	81	4	30	1	81	3	32	1	53	2
B.G. 75 ..	30	2	80	4	109	4	140	6	256	9
Sonacalif	13	1	16	1	71	2	48	2	62	2
China Patna	....	....	31	1	50	2	32	1	97	4
New Guinea	....	....	....	....	22	1	59	2	248	9
Other varieties	2	....	4	....	23	1	11	1	33	1
Total	1,863	100.	2,346	100	2,843	100	2,462	100	2,724	100

Features of plantings in Macuata have been a steady reduction in the area under *Motka*, and increases in acreages planted to *New Guinea* and *B.G. 75*, the latter being particularly popular in the Dreketi district having been first under trial at Labasa in

1941-42. In 1946 *Ramcajara* and *Lakra-hawa* were again tried out at the Labasa Nursery, and farmers purchased all seed padi available after the crops were harvested. Increased plantings of *Ramcajara* are anticipated in 1947.

TABLE III—PROVINCE OF BUA.

Variety.	1941-42.		1942-43.		1943-44.		1944-45.		1945-46.	
	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.
Motka ..	554	72.	716	80	673	70	560	59	338	40
Patna ..	173	22	148	16	163	17	149	16	172	20
Lautoka	19	3	....	....	....	....	20	2	12	2
B.G. 75	....	....	....	....	....	....	11	1	11	1
China Patna	18	2	23	3	85	9	154	16	267	31
New Guinea	....	....	....	....	18	2	47	5	46	5
Other varieties	8	1	12	1	20	2	6	1	8	1
Total	772	100	899	100	959	100	947	100	854	100

In Bua, farmers have regarded *China patna* which is a mid-season rice as being the best substitute for *Motka*, but *New Guinea* has rapidly increased in popularity

and should soon be the most popular variety in this province. *Ramcajara* was introduced to Bua in 1945.

TABLE IV—PROVINCE OF CAKAUDROVE.

Variety.	1941-42.		1942-43.		1943-44.		1944-45.		1945-46.	
	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.	Acres.	Per cent of crop.
Motka ..	133	44	187	49	264	51	116	39	148	33
Lautoka ..	44	14	33	9	91	18	60	21	23	5
Karia ..	67	22	63	16	62	12	24	8	65	15
Sonacalif ..	24	8	26	7	23	4	15	5	32	7
B.G. 75 ..	24	8	18	5	.....	.....	.....	.....	.....	.....
Patna ..	12	4	54	14	44	8	39	13	30	7
China Patna ..	.....	.....	.....	.....	.....	.....	12	4	20	4
New Guinea ..	.....	.....	.....	.....	.....	.....	13	4	89	20
Jhinwa ..	.....	.....	.....	.....	.....	.....	.....	.....	18	4
Other varieties	1	.....	4	1	34	7	14	6	21	5
Total	305	100	385	100	518	100	293	100	446	100

In Cakaudrove, *Motka* has also decreased in popularity and, as in Bua, *New Guinea* has become very popular.

SUMMARY OF AREAS PLANTED.

Table V shows the number of farmers and area planted per province, average area planted per farmer, and the percentage of crop planted in each province.

TABLE V.

	No. of farmers.	Area.	Av. per farmer acres.	Per cent crop.
1941-42—				
Macuata ..	514	1,864	3.6	63
Bua ..	164	772	4.7	26
Cakaudrove ..	114	304	2.7	11
Totals ..	792	2,940	3.5	..
1942-43—				
Macuata ..	670	2,346	3.5	65
Bua ..	189	900	4.8	25
Cakaudrove ..	141	385	2.7	10
Totals ..	1,000	3,631	3.7	..
1943-44—				
Macuata ..	714	2,843	4.0	66
Bua ..	187	959	5	22
Cakaudrove ..	227	518	2	12
Totals ..	1,128	4,320	3.7	..

	No. of farmers.	Area.	Av. per farmer acres.	Per cent crop.
1944-45—				
Macuata ..	722	2,462	3.4	66
Bua ..	186	947	5.1	26
Cakaudrove ..	168	293	1.7	8
Totals ..	1,076	3,702	3.4	..
1945-46—				
Macuata ..	721	2,725	3.8	..
Bua ..	193	854	4.4	..
Cakaudrove ..	175	445	2.5	..
Totals ..	1,089	4,024	3.6	..

In season 1943-44 each province planted record crops, and the acreage planted in that season was very little short of the estimated maximum acreage possible on existing rice areas outside the cane areas, i.e. 4,572 acres. This figure was obtained by adding the optimum plantings in each district during the period under review. The calculated maximum areas possible on existing rice settlements in each province is Macuata 2,863 acres, Bua 1,117 acres and Cakaudrove 592 acres. An examination of Table V shows that in season 1943-44 plantings were only 252 acres short of the computed maximum acreage possible

on existing areas. It will be seen therefore that although improved cultural methods and the use of better varieties would undoubtedly increase yields, the need for additional rice settlements is real.

YIELDS.

Average yields varied from 8 to 10 bags (= 20 to 25 bushels) per acre, the best yields being recorded in season 1945-46 when excellent conditions for rice growing existed.

PESTS AND DISEASES.

The condition known as rice yellows was met with each year. Although all varieties are said to exhibit the condition. *Motka* was badly attacked each year and for this reason farmers have reduced plantings of this variety which has been popular for many years. Cases of total destruction of crops were recorded. Other pests and diseases recorded were Leaf roller, leaf spots and Army cut worms, the latter being particularly bad when the 1946 crop was being harvested. Pigs caused damage to rice crops in all parts and control was most difficult, the damage reported in 1946 being the worst to date. Muraina grass* was common throughout the division being particularly aggressive in Bua and Macuata.

MARKETING.

Until 1946 no organized system of marketing existed. In 1945 competition for padi was very keen and black marketing was rife. It was decided, in 1946, to purchase the requirements of the Labasa district co-operatively, and at the suggestion of the Agricultural Officer Northern one buyer who had agents in Dreketi, Lekutu and Nasorowaqa purchased the districts requirements with the minimum of trouble. In seasons 1944-45 and 1945-46 surplus padi from the district of Bua was purchased by the Supply and Production Board.

DIVISION ACTIVITIES.

During the period under review every effort was made to increase production and a measure of success was achieved. The staff of the division concentrated on the advocacy of improved cultural methods and high yielding varieties. Draining, leveling and bunding on existing rice areas, and

the control of rice yellows were carried out annually. Two new rice settlements were established.

Seaqqa, Macuata Province.—In 1942 the Director of Lands agreed to the issue of temporary licences to occupy native land being granted to Indian peasant farmers in Seaqqa. The Agricultural Officer Northern (M. D. French-Mullen) made a prismatic compass survey of the area; and 82 blocks containing 552.4 acres were settled. It is estimated that there are 454 acres of rice land in this settlement. Assisted by grants of money, farmers co-operated in the building of a fair weather road and in the construction of bridges. The settlement has progressed as the figures shown below will indicate.

ACREAGES UNDER PADI, SEAAQA.

1943.	1944.	1945.	1946.
146.8	294.3	294.2	308.8

Korokade, Bua Province.—This settlement, after having been surveyed by the Staff Surveyor Northern, was settled in 1943. Farmers took 27 blocks and this settlement too has prospered. Areas planted annually since the inception of the settlement are: 1943, 57.7 acres; 1944, 110 acres; 1945, 197.7 acres; and 1946, 134.4 acres.

CONCLUSION.

The Vanua Levu section of the division has been self-supporting to date, and it is hoped that the proposed Labasa-Dreketi road will make further lands available for rice settlements.

INSECTICIDES

The following insecticides are available at the Department of Agriculture. Address all inquiries to the Produce Inspector, No. 4 Shed, Suva Wharf (telephone No. 649) or to Accountant, Department of Agriculture (telephone No. 4).

Pyrethrum powder in 1 lb cartons—
4s. 6d. lb up to 28 lb; 4s. 3d. 28-112 lb.
4s. cwt. lots.

Kryocide—1s. lb.

Sulphur—6d. lb.

Paris Green—2s. 3d. lb.

**Ischaemum rugosum* Salisb.

AGRICULTURAL NOTES

1. RICE VARIETIES GROWN BY CANEGROWERS 1946/47

By courtesy of the Chief Manager in Fiji, Colonial Sugar Refining Company Ltd., the following records of areas and varieties of rice planted by cane growers during the season 1946-47 have been made available.

TABLE I—RICE VARIETIES GROWN BY CANEGROWERS (1946-47).

Variety.	Area cultivated in each district.					Total area of each variety.
Usual name and synonyms.	Nausori.	Penang.	Rarawai.	Lautoka.	Labasa.	
	acres.	acres.	acres.	acres.	acres.	acres.
Motka (= Table = China)	89	1,261*	1,709*	418	3,477	
China Patna (= Lakarawa = English) .. .	392	789	582	1	2,727	
Bandala (= Lautoka = Lalki) .. .	191	594	471	1,256		
Ramcajara	1,115	1,115	1,115			
New Guinea	134	22	492	648		
Patna	79	202	204	485		
Sereya Patna	95	278	373			
Karia Patna (= Black Patna) .. .	8	38	280	326		
Sonacalif	109	197	306			
Chetua (= Gazi)	1	9	222	37	269	
Motmuria	233	15	248			
Gerhan (= ? Jadhan)	153					
Basmatia (= Pataalka)	49	59	30	138		
Dihula (= ? B.G. 75)	125	125				
Motki	42	42				
Kankjeer (= Jhinwa)	40	40				
Muraya (= ? Turuawa)	9	9				
Ramborg	6	6				
Miscellaneous (not specified)	23	59	82			
Total (acres)	2,453	658	3,164	3,279	2,271	11,825
Percentage of total area	21	6	27	28	18	100

* It is considered probable that these figures include areas planted to Bandala variety.—ED.

Several interesting features may be noted.

1. *Motka* variety, formerly widely grown has disappeared from the Nausori district and the areas grown in Labasa and Penang districts are shown to be much reduced (viz. 10.6 per cent and 13.5 per cent of total area respectively). It appears to have retained its popularity in Rarawai (Ba) and Lautoka (40 per cent and 52 per cent respectively). This is a later maturing variety with an extended growth period.

2. The most widely grown variety in the Nausori (Tailevu-Rewa) district is *Ramcajara* with 1,115 acres (= 45 per cent of the total area). This is the high-yielding variety introduced by the Department of Agriculture and distributed to farmers from

Naduruloulou. Its steadily increasing popularity with growers in this district has been recorded in previous Reports (1, 2, 3), but this is the first year that the area grown has exceeded that devoted to any other variety. It was selected in 1939 as a suitable variety for cultivation by cane growers, not only on account of its heavy yielding capacity but also because of its early maturation, its robust straw and its good food quality. Although recorded for only one district *Ramcajara* now ranks as the fourth most important variety grown in sugar districts throughout the Colony.

3. In the Nausori district the preponderance of the three varieties *Ramcajara*, *China Patna* and *New Guinea* is noteworthy

(91 per cent of the total area of 2,543 acres). The seven other varieties grown occupy only 241 acres.

4. *New Guinea* variety, also distributed by the Department of Agriculture, is now the most important of the ten varieties grown in the Labasa district where it occupies nearly 22 per cent of the total area—and where amongst canegrowers it has to a considerable degree replaced *Motka*.

5. Considering total production in cane areas the order of importance is of interest with *Motka*, *China Patna*, *Bandala* and *Ramcajara* much in advance of all other varieties and together accounting for 72.5 per cent of the total area planted to the 19 varieties listed.

6. The methods of planting padi practised by cane growers is shown in the following table:—

—B.E.V.P.

TABLE II—METHODS OF PLANTING PADI.

Method.	Nausori.	Penang.	Rarawai.	Lautoka.	Labasa.	Total.
	acres.	acres.	acres.	acres.	acres.	acres.
Transplanted	2,021	83	1,087	891	980	5,062
Broadcast	432	165	1,734	1,881	1,177	5,389
Drilled .. .. .	....	410	343	507	114	1,374
Totals	2,453	658	3,164	3,279	2,271	11,825

2. HEDGE AND FENCE PLANTS

The continuing shortage of barbed wire has compelled farmers to give attention to the possibility of utilizing hedges of suitable plants in the place of fences. Amongst the plants readily available locally are many which, if properly established and maintained, will serve the purpose admirably. The following are recommended:—

For dry areas.

Pigeon berry¹ propagated readily by cuttings—when well grown is quite cattle proof.

Dadap² known locally as “Drala”—several species of rapid growth are easily grown from cuttings, branches or stakes.

Madras thorn or Manila tamarind³—now common in the Penang district and at Ba is usually grown from seed and rapidly forms a strong hedge.

Jujube or Chinese date⁴ is a small thorny tree now growing wild in parts of Ra province—propagated by seeds or root cuttings.

Physic Nut or “Banidakai”⁵—is commonly used locally and is easily propagated from cuttings.

Sappanwood⁶ is a small strong tree which stands cutting well. It is grown from seeds or cuttings.

Bougainvillea requires support in the early stages and must be trimmed frequently to form a hedge.

Other species used are Annatto and *Gliricidia*.

For wet areas.

Seville orange and West Indian lime—propagated from seeds form effective barriers and stand trimming very well.

Chinese Lime⁷—is an evergreen shrub armed with short sharp spines which is recommended by Howes⁽¹⁾ as one of the best all-round hedge plants for the tropics.

Henna or Mignonette Bush⁸ grows rapidly and forms a very strong impenetrable hedge—it is propagated by cuttings.

Bougainvillea, “Drala”, *Gliricidia*, *Lantana*, Annatto have also been used in the wet zone with very good results and are usually recommended.

As many of the plants recommended for live cattle fences are of a spiny or thorny

¹ *Duranta repens* L.

² *Erythrina indica* Lam.

³ *Pithecellobium dulce* Bth.

⁴ *Zizyphus jujuba* Lam.

⁵ *Jatropha curcas* L.

⁶ *Casalpinia sappan* L.

⁷ *Triphasia trifolia* P. Wils.

⁸ *Lawsonia inermis* L.

nature, care must of course be taken that they are regularly trimmed and kept within bounds. Local examples are Ellington curse, Lantana and Madras thorn—all of which make excellent hedges, but which, through neglect, have spread widely and become a nuisance in some localities.

Howes (l.c.) recommends double planting where hedges are intended to resist cattle. For hedges 3-4 feet in height a 6-12 inch spacing is usually given, and for those six feet high not less than 1½ feet. The ideal shape for a hedge is, of course, tapering or wedge-shaped (widest at the bottom) as

this allows more light to reach the lower branches and results in healthy and dense growth near the ground. Most hedges are widest at the top due to attempts to cut the sides on the perpendicular and usually are open and badly formed at the bottom.

Planting material of the species mentioned in this note is readily obtainable in most districts and can also be supplied from the Agricultural Stations of the Department.

—B.E.V.P.

REFERENCE.

- (1) Howes, F. N.—Fence and Barrier Plants in Warm Climates, Kew Bulletin, No. 2, p. 51.

3. PRODUCE

The following list shows the quantities of produce, other than copra and sugar, shipped overseas for the period 1st January to 30th June, 1947, the value of which was £163,657 approximately.

Bananas	5,121,270
Peanuts	540,430
Green Ginger	60,750
Mixed Fruit	26,260
Pineapples	1,440
Mixed Vegetables	8,630
Pawpaws	260
Mandarins	44,520
Oranges	3,000
Grapefruit	660
Arrowroot	1,170
Coconut meal	1,595,888
Rice bran	460,530
Tapioca Starch	2,688
Avocado Pears	350
Water Melons	1,768
Taro	1,440
Mangoes	240
Candlenuts	72,450

4. CROPS IN WESTERN DISTRICTS

During the quarter ending 30th June the following crops were grown by farmers other than Fijians in the Western districts (Provinces of Nadroga-Navosa) and Ba (Nadi and Lautoka districts only):—

Crops.	Growers	Area (acres).	Remarks.
Cereals—			
Maize	132	192.3	
Millet	2	5.3	Lautoka only.
Pulses—			
Pigeon pea	296	267.8	
Cowpea	165	76.1	
Other	381	252.2	
Roots—			
Potatoes	65	56.9	Nadroga only.
Kumalas	7	2.2	
Tapioca	30	9.8	
Oil Seeds—			
Peanuts	278	271.6	
Other	39	27.8	
Miscellaneous—			
Tobacco	116	98.8	
Spices	20	5.7	Nadroga and Lautoka.
Fibre plants	1	.1	Nadroga.
Melons	11	5.1	
Garden vegetables	124	30.9	

5. CENTRAL AGRICULTURAL STATION, NADURULOULOU, 1928-1947

On 30th June, 1947, with expiration of the lease of land at Muanisei and Navuso, the Department of Agriculture abandoned the main area of the Central Agricultural Station which has been in existence since 1928. The following brief notes on the work carried out during the period of nearly 20 years is recorded as of general interest.

The Navuso Experimental Station, as it was then known, was originally established as a general experimental station for the wet zone with particular reference to coconuts and bananas (Barnes ⁽¹⁾, ⁽²⁾). From 1933 to 1946 it was also the centre of pathological and botanical work and of field extension services for the Southern division (present provinces of Rewa, Tailevu, Naitasiri, Ra, Kadavu and Serua).

The major projects undertaken were—

(1) Investigations in the control of Banana and other crop disease.

(2) Experimental investigation of agricultural and food crops.

(3) Production of pure line seed and selected plants for distribution.

(4) Training of Fijian youths in practical agriculture.

(5) Advisory work in plant diseases, botanical and agricultural matters.

Progress made with this work during the period has been reported annually but may be briefly stated—

Bananas.—The experimental plots maintained for ten years enabled the causes and control of "Sigatoka" disease to be investigated with success. The selection of banana strains resistant to Bunchy-top virus diseases was carried to an advanced stage; also the collection and study of some 50 banana and plantain varieties and the introduction and propagation of banana varieties from West Indies, including the hybrids S. 19 and I.C.2. and also Manila Hemp. Cultivation and manurial experiments were conducted; the control of banana pests and the economics of disease control methods were studied in considerable detail. Cover-cropping and composting in connexion with banana cultivation, received much attention in the field programme.

Rice.—This important crop has received constant attention. Upwards of 20 varieties have been propagated and studied, including

the introduced high-yielding strains from British Guiana. Several of these have been liberated and are now being grown by Indian and Fijian cultivators with great success in many parts of the Colony. Large supplies of pure-line seed have been produced for distribution.

Coconuts.—The station plots comprised two acres of hybrid dwarf palms and one acre of Rotuman coconuts, established by Mareschal⁽³⁾ and Surridge⁽⁴⁾.

From the time of first flowering the hybrid palms were under close observation for six years and the best trees have been selected for further propagation. Very large numbers of seedling coconuts have been distributed throughout the Colony and to overseas research stations.

Investigations have been carried out on the production of good quality copra, coconut charcoal and other by-products.

Citrus and other Fruits.—A small orchard was established in 1931 of budded stock of ten varieties received from Trinidad and this has been added to from time to time. Growth has been good and increasing yields of excellent quality fruit have been obtained.

Other fruits cultivated for observation and propagation were grenadilla, passion-fruit, bellapple and pawpaw.

Minor Crops.—Particular attention has been devoted to the study of food-crop varieties. In the course of the work 15 varieties of sweet potatoes, six of cassava and 60 of taro were under observation and some 24 varieties of yams were cultivated.

Other crops as Soya bean, *Derris*, ginger, arrowroot, maize, sweet corn, vegetables and green manure crops received much attention and the native spinach plant "Bele"¹ and the grass "Duruka"² were also studied.

Particular attention was given to the propagation of the fibre plants—Masi³ or Paper Mulberry; Ramie Fibre⁴, Manila hemp, kapok, and in recent years to the introduction of Kavirondo sorghum, *Derris* (Amani strain) and other economic crop plants.

¹ *Hibiscus manihot* L.

² *Saccharum edule* Hassk.

³ *Broussonetia papyrifera* Vent.

⁴ *Boehmeria nivea* Gaud.

Student Training.—In 1931 the student training scheme commenced with four students and altogether nearly 200 Fijian youths have passed through the station. An account of this work has been given by the present writer⁽⁵⁾.

History of Station.—The station was established and the coconut plot of hybrid seedlings planted in 1928. Building and garden sites were provided on the hill section at the back of the station, together with a reserve of 200 acres for use as required by the Department of Agriculture. An implement shed and office were erected on the flat.

In 1930 the scope of the station was enlarged to include banana and rice cultivation and a wide range of general crops with a view to the establishment of an agricultural experimental station for the wet zone. A dormitory for students and a rice store were built on the hill.

In 1930-31 a banana plantation was established, not only to enable the study of cultivation methods, pests and diseases but also to provide "disease free" plants for distribution: considerable areas were planted with rice, both wet and upland varieties, and pasture grazing experiments were laid down.

In 1932 the banana plantation was severely infected with "Sigatoka" disease which was also prevalent throughout the banana areas of the Colony.

Up to this time the station had no resident European Officer in Charge and was worked from a distance; but late in 1932 quarters were built and in 1933 an officer was appointed for research in connexion with banana diseases; a small laboratory was built and equipped by the end of the year.

Staff changes in 1934 involved the rapid development of general field duties which much reduced the time available for consistent research. Funds were reduced but development of new land was undertaken and considerable progress made.

In January 1936 boundaries were re-defined to comprise a total of 85 acres; the area was surveyed, fenced, drained, the buildings extended and a considerable area put under cultivation. In June, however, the reduction of the area to 22 acres involved the abandonment of the hill area,

some 25 acres of new cultivation including 12 acres of bananas and the removal of all buildings. In the course of this retrenchment, much valuable plant material was lost; but by the courtesy of the District Administration an area of Crown Land at Naduruloulou was made available and the banana and rice variety plots re-established there.

In 1937-40 laboratory buildings were enlarged and the whole of the available area put under cultivation and experiments of increasing value undertaken. An insectary was built for the carrying out of experimental work under controlled conditions and the office was extended to provide space for the botanical collections which are now of considerable value.

The hurricane of February 1941 destroyed most of the minor buildings—and many experimental crops; but these difficulties were surmounted and the work of the station re-established in so far as the extraordinary conditions during war time permitted.

Since 1944 the programme has been maintained on a reduced basis pending a decision on the recommendation of Professor Shephard⁽⁶⁾ regarding the establishment of the principal Agricultural Station for the Colony.

In anticipation of the abandonment of this area in the present year, measures were taken during 1946 to establish all minor crops elsewhere so that there should be no great loss of valuable plant material accumulated over a considerable period. It is hoped finally to ensure that the valuable coconut plots are maintained for further investigational work when opportunity occurs.

—B.E.V.P.

REFERENCES.

- (1) 1929. Barnes, A. C.—"Annual Report of Department of Agriculture for 1928". C.P. 83, p. 2.
- (2) 1930. Barnes, A. C.—"Annual Report of Department of Agriculture for 1929". C.P. 42, p. 4.
- (3) 1928. Mareschal, H.—"Observations and Experiments on the Coconut Palm". *Agricultural Journal Fiji*, Vol. 1, No. 2, p. 16.
- (4) 1933. Surridge, H. R.—"Annual Bull. Div. Reports Department of Agriculture Fiji", p. 3.
- (5) 1946. Parham, B. E.—"Agricultural Training Scheme". *Agricultural Journal Fiji*, Vol. 17, No. 4, p. 112.
- (6) 1944. Shephard, C. Y.—"Report on Agricultural Policy for Fiji and the Western Pacific High Commission Territories." C.P. 24, p. 15.

6. FOOD AND CASH CROPS GROWN BY CANEGROWERS

(The following record of subsidiary crops grown by cane growers has been provided by the Chief Manager in Fiji, Colonial Sugar Refining Company Ltd.—*Ed. Agric. Jnl.*)

Crop.	District.					Total
	Nausori.	Penang.	Rarawai.	Lautoka.	Labasa.	
	acres.	acres.	acres.	acres.	acres.	acres.
Pulses (Arkar dhal) .. .. .	....	....	....	383	66	449
Pulses (other varieties)	94	525	1,642	1,915	381	4,557
Maize	1	73	1,024	428	91	1,617
Peanuts	1	22	821	....	57	901
Vegetables	4	45	86	....	55	190
Roots	17	15	....	....	30	62
Total (acres)	117	680	3,573	2,726	680	7,776

LEGISLATION 1947

During the March session of Legislative Council the following Ordinances and amendments relating to agriculture were dealt with.

An amendment to the Land (Transfer and Registration) Ordinance (No. 1 of 1947) makes provision for the inclusion in agricultural leases of covenants or conditions for the protection of land fertility, for prevention of soil erosion and for controlling the giving of assignments, encumbrances or liens on or over crops grown on the land to be leased.

The Ordinance to make provision for the Protection of Certain Industries (No. 2 of 1947) will encourage development of approved industries which, owing to special circumstances, could not otherwise be developed.

The Co-operative Societies Ordinance (No. 13 of 1947) came in for widespread support in principle and provoked an interesting debate. This important measure should greatly assist the agricultural production and marketing by small farmers and will enable the many small clubs and associations already operating to be established on a sound basis. The appointment of a Registrar of Co-operatives is contemplated.

Ordinance No. 12 of 1947 imposes a tax on all sugar exported from the Colony at such rate not exceeding ten shillings a ton as the Governor in Council with the approval of Legislative Council may determine; every such order to be valid for a period of one year from the date upon which it comes into force.

Ordinance No. 16 of 1947 provides an Amendment to the Animals (Contagious Diseases) Ordinance, making it lawful for a Veterinary Officer or for an inspector authorized by the Director of Agriculture to order the destruction of any animal if satisfied that the animal is diseased.

At the July session of Legislative Council Candlenut oil was declared to be a Protected Industry under Ordinance No. 2 of 1947.

The following Order was made:—

"1. This Order may be cited as the Protected Industries (Industrial Oil) Order, 1947.

2. The purchase within the Colony of the fruit of the Candlenut tree, *Aleurites moluccana*, the export of such fruit, the manufacture therefrom of industrial oil, the processing and refining of such oil and the sale and export thereof is hereby declared to be a protected industry." (C.P. 28 of 1947.)

ENTOMOLOGICAL NOTES

1. PLANT QUARANTINE PROBLEMS IN THE PACIFIC

Recent reports from Hawaii refer to the serious problem of preventing the entry of new insect pests in planes and ships from outside countries.

Dr. C. E. Pemberton⁽¹⁾ states that "the eradication of insects carried in aircraft coming to Hawaii has assumed not only territorial but also national importance."

By August 1944 exotic insects began to show up and by October 1946 entomologists had recorded a total of 21 species previously unknown in the territory. Of these nine are pests on various plants, seven are beneficial and five are of no economic importance.

In another report⁽²⁾ the same author describes introduction of the fruit fly* which attacks mangoes, citrus, roseapples, guava, papaya, bananas and many other fruits. In May 1946, this insect was suddenly discovered and found to be well established in Hawaii. It is thought to have been introduced in infested fruit carried by the crew or passengers in planes from Saipan during the war.

Dr. E. C. Zimmerman⁽³⁾ refers to the many new problems relating to agriculture

and quarantine brought by the war and air transport and to the great need for scientific exploration and study in the Pacific area. He considers that "the air and surface ships will continue to be sources of economic losses through their acting as carries of insect pests", and urges the need for full public support and interest in the task of protecting agriculture by reducing as much as possible the numbers of pests which break through the barriers.

Fiji, situated at the centre of Pacific air routes is faced with the same problem; and the utmost vigilance of the technical officers concerned will not suffice without the full co-operation of the travelling public.

—B.E.V.P.

**Dacus dorsalis* Hendel.

REFERENCES.

- (1) 1946. Pemberton, C. E.—"A New Fruit Fly in Hawaii" Hawaiian Planters' Record Vol. L, No. 2, p. 53.
- (2) 1946. Pemberton, C. E.—Hawaii's Insect Quarantine Problems. ib. Vol. L, Nos. 3 and 4, p. 105.
- (3) 1946. Zimmerman, E. C.—"Gleanings from Mainland Conferences and some aspects of Hawaiian Entomology." ib., p. 111.

2. CONTROL OF MITES AND RED SPIDERS

Mites and red spiders on the hibiscus, citrus and brinjal plants are very small and often nearly invisible. They infest practically all types of plants. The presence of both insects can usually be detected by the curling or rolling of leaves, thinning of tissue, small, narrow or otherwise unusual type development of foliage, and on some plants by marked silvering and russeting with loss of normal green colour. Certain beneficial insects feed to some extent upon these insects but they are seldom of sufficient abundance to give satisfactory control.

Control of mites and red spiders consists in the use of sulphur or oil emulsions. Sulphur may be applied in two ways, either in dust or in liquid form. If sulphur dusts are used they should be applied at least once a week using particular care to get coverage on the backs of the leaves. If the hand dusters are used to apply sulphur the lips on the duster should be turned in such a

way that the blast of the dust can be directed from the bottom of the plant upward. Throwing dust onto the top of the plant by hand is often very wasteful and excess material may cause serious burns. Wettable sulphur can be used like any other spray but it must be directed especially at the back of the leaves since this is where the insects most generally congregate. The dust sulphur should be applied early in the morning when the plants are still covered with dew and no rain is expected.

Oil emulsion can be used for the control of mites and red spiders. In addition to killing the adults, oil will destroy the eggs—sulphur compounds will not do this. Four level tablespoons of oil emulsion in three gallons of water should give satisfactory control. Applications should be repeated about three times at one week intervals if satisfactory control is to be secured.

—J. ULUINACEVA.

3. CONTROL OF SLUGS

Slugs are often a severe pest in gardens, especially in damp corners. When the plants are in the seedling stage the effect of the damage can often be very severe, the slug usually stripping the plant of its foliage and often killing it. About this time of the year the growers often find slugs troublesome in the seedling beds. Therefore, the following methods of control, recommended by the Entomology Division, may be useful where slug infestation occurs.

Clean surroundings.—Since slugs seek shelter among debris and long grass it is a good policy to clean the ground for some distance surrounding the seedling bed. Then on the clean ground lay down boards, sacks and cabbage or lettuce leaves. It will be found that the slugs congregate under this shelter and can be collected daily and destroyed.

Poison bait.—The best control for slugs is the poison bait made from metafuel, for

they find the chemicals contained in this "meta" very attractive.

The following formula is also recommended:—

Calcium arsenate	..	1 lb
Bran ...	..	16 lb
Molasses	..	1 pint
Water ..	..	2 gal.

The bran and the calcium arsenate are mixed dry, the molasses being mixed with water added to the bran, the whole being well mixed together. Only enough water should be used to make the bait crumbly and not over moist. The bait should be broadcast lightly among the plants during the late afternoon so that it will be fresh when the slugs feed in the evenings. Paris green may be used instead of calcium arsenate in which case the quantity of bran should be increased to 20 or 25 lb.

—J. ULUINACEVA.

4. INSECT PESTS OF RAIN TREES

Advice has been received recently from Hawaii that the fine rain trees which hold a permanent place in the beauty of the public gardens, parks and residential parts of Honolulu are seriously threatened by the ravages of caterpillars. Hundreds of trees have been bare of leaves for months and many appear to be dying. The pest attacks other species of the family Leguminosae and is causing great concern.

The caterpillar is that of a moth *Polydesma umbricola* which was recorded by Mr. R. J. A. W. Lever in 1941 as causing damage to rain trees in Suva. The attack was very local and no further outbreak has been noted.

It is not doubted that the pest reached Hawaii in an air plane during 1945 from some island region in the South Pacific and a search is now being made locally for specimens in order to determine whether a parasite has been responsible for its apparent control.

This is yet another example of the dangers occasioned by development of air transport and the necessity for increasing vigilance on all occasions. Amongst the Leguminosae are plants of great economic importance and a pest of this character represents a very certain menace.

—B. E. V. P.

GROUNDNUTS

The interest in this crop stimulated by good export prices offering earlier in the year has been sustained although there has been some reduction recently in the price. Owing to the uncertain market particularly as regards the quantity required and the stability of prices, it was not possible to recommend very greatly increased production. Growers have, however, themselves

greatly increased their areas and export has continued almost to the limit of shipping space available. The crop is a valuable one for the drier districts and it is to be hoped that a steady demand will develop at attractive prices. The prospects of local milling and also of export to Canada have been investigated.

BANANAS

As a result of official representations the price of bananas was advanced in May by one shilling per case and this has been shared equally by the growers and the shippers. Production of fruit has increased, quotas have been well filled: but the quality of the fruit has caused some concern mainly on account of premature ripening and the incidence of transport diseases. Experiments are in hand designed to meet some of these problems and it is hoped that recent new plantings in several areas will result in a great improvement. From overseas reports it is evident that there has been considerable improvement in the quality and grade of Fiji fruit generally.

Arrangements for sale of Fiji bananas in Western Canada have been finalized and consignments will be made as soon as shipping is available.

WILT DISEASES

Many gardeners complain of wilt diseases attacking their annuals, as tomatoes, asters, antirrhinum and phlox. Very useful results have been obtained over a number of years by the use of Cheshunt compound solution with which the young seedlings may be watered before and after planting out. Cheshunt compound, which is a mild soil sterilizing agent does not harm growing plants. It is prepared by grinding separately two ounces Bluestone and 11 oz. ammonium carbonate, then mixing thoroughly together. It should be stored in a tight stoppered jar and used at the rate of $\frac{1}{2}$ oz. per gallon of water. It is easily dissolved in a little hot water which is then made up to the requisite quantity of cold water. Soak the soil thoroughly and use at intervals of 8 to 10 days. Usually three applications are sufficient. See also *Gardening Notes* obtainable from the Librarian, Department of Agriculture.

COPRA

In June an increase of £9 4s. 0d. per ton in the price of copra was announced, bringing the Suva and Levuka rates to £36 19s. 0d. for Plantation and £36 13s. 6d. for F.M.S. grades respectively.

NOXIOUS WEEDS

Good progress has been made with the implementation of the proposals for more adequate weed control measures in the Colony. Experimental work has been continued with useful results and methods for the effective control of major weeds have been worked out.

Recently discovered minor infestations of Prickly Pear have been effectively dealt with by the Department of Agriculture, and demonstrations have been given of the latest methods for the control of water hyacinth, Noogoora Burr and other important weed species.

Action by dairy farmers in the proclaimed areas has been effective; but there is need for the co-operation of all land-holders and for the better management of land and stock.

A Weeds Officer has been appointed and recently arrived in the Colony.

EXTENSION WORK

Several projects of the Department of Agriculture have included the demonstrations in co-operation with farmers of various methods of soil conservation, the construction and operation of cattle pens for the preparation of farmyard manure, the provision of food types of male stock for the improvement of farm animals and the distribution of large quantities of rice and other crop seeds.

In the course of investigational work the co-operation of farmers has also been obtained particularly in connexion with pasture improvement and weed control trials which have made good progress.

RICE HARVEST

Harvest returns are much better than was anticipated. Despite very dry weather experienced at planting time which reduced the total area grown, conditions were favourable during the growing period and good crops have been obtained. The total area of some 25,000 acres is estimated to represent a total production of 13,000 tons of rice (80 per cent of the previous year's yield).

BOTANY NOTES

1. NOXIOUS WEEDS—PRICKLY PEAR

Infestations of Prickly Pear have recently been discovered in the Ba district near the town of Tavua. The species is determined as *Opuntia vulgaris* Mill. one of the common thorny species of Cactus commonly known as Prickly Pear and regarded as a dangerous weed in most tropical and sub-tropical countries with dry climates.

2. The infestations at Tavua are not extensive, comprising scattered clumps along the face of rocky banks on the foreshore just above high tide mark. The plant would appear to have been established for many years without spreading very widely in the locality. A survey is being carried out under the supervision of the Stock Inspector and Agricultural Assistant and will extend for several miles on either side of Tavua, including Vatia peninsular and Vatialailai where infestations are reputed to exist.

3. *Control*.—In Australia and other countries biological control has been most successful; but on account of the scattered distribution of the local infestations it is considered best not to delay action pending any attempted introduction of the beneficial parasites. Action has been taken locally to investigate the possibility of destroying the plants with one of the available weedicides and trials have already been instituted. If the results are satisfactory weedicides will be used but in the meantime a field campaign has been organized aiming at

thorough eradication of all plants which can be found and their burial at depth. Consideration will also be given to the introduction of beneficial parasites. The plants seen at Tavua have been attacked by an unidentified insect—many of the stems and forests being affected—but not seriously.

4. The presence of this weed was reported to the Director of Agriculture on 26th May by Sir H. H. Ragg who brought in specimens collected by Mr. Sanday of Tavua. The latter reports that the weed occurs for some distance along the Tavua coast at Rabulu and Vatialailai, and occasional plants have been seen inland. He states that Fijians relate that the plant was brought to the locality from Levuka many years ago and that it has been seen in Vanua Levu. His services were obtained to assist with the location of other stands which may occur in the district. Spraying trials were made and all existing stands have since been eradicated by the Department.

5. *Opuntia Spp* (not specified) were proclaimed as noxious weeds in the Colony during 1945 and should not be confused with the Cochineal Cactus* which is usually devoid of spines when well grown. Owing to its very slow growth and spineless habit this plant is not regarded as a noxious weed.

—B.E.V.P.

**Nopalea Cochinellifera* Solms Dyck.

2. IMPORTATION OF ROSES FROM NEW ZEALAND

For some time past the importation of rose plants and other members of the family Rosaceae, from New Zealand has been prohibited on account of the assumed risk of the introduction of the bacterial disease known as "fireblight".

The matter has recently been taken up with the New Zealand authorities and as a result of information received, the Director of Agriculture has approved the removal of the restriction on rose plants, provided that importers obtain a permit to import and arrange for the provision of a plant health certificate from the New Zealand Depart-

ment of Agriculture. Persons wishing to import rose plants (including bud-wood and cuttings) from New Zealand, should therefore apply to the Department of Agriculture, Suva, for a permit to import. It is necessary to specify the number of plants, the firm from which they are being obtained and the anticipated time and port of entry to the Colony. When arranging the supply of the plants they should ask to have them inspected by a duly authorized official of the Department of Agriculture in New Zealand and obtain the requisite certificate of freedom from disease.

The necessity of these precautions is obvious. Although it is now established that rose plants are not liable to infection by the fireblight organism and are not likely to transmit the disease, it is known that roses in New Zealand are subject to attack by a number of pests and diseases; amongst these may be mentioned:

Pests.

Rose scale (*Aulacaspis rosæ*) a serious pest of roses and raspberries.

Rose aphids (*Macrosiphum rosæ*) and others.

Leaf Roller (*Tortri* sp.)

Diseases.

Rose rust (*Phragmidium mucronatum*)

Rose black spot (*Diplocarpon rosæ*).

Rose mildew (*Sphaerotheca pamosa*).

Blast (*Pseudomonas syringæ*).

Importers will appreciate, therefore, that while the Department of Agriculture wishes to facilitate the legitimate importation of roses and other plants from overseas, it is necessary that every care be taken to ensure only healthy plants being introduced. Generally, it is preferable that plants be obtained from established nurserymen rather than from private sources, and the issue of permits is governed accordingly.

—B.E.V.P.

STAFF NOTES

Up to date of publication the following officers have arrived in the Colony to take up new appointments in the Department.

A. D. Mercer (Dip. Agric. Reading) Weed Control Officer.

F. M. Reid (Dip. Canterbury Agric. College, N.Z.) Agricultural Assistant.

D. J. G. Davies (Dip. Caterbury Agric. College, N.Z.) Livestock Officer.

C. Whitehead (Dip. of Queensland Agric. College) Farm Manager.

R. J. Nesbitt, Meat Inspector.

L. E. Smythe, M.Sc., A.A.C.I., A.R.I.C., Chemist.

The following new posts have been filled by the appointment of members of the Department.

Deputy Director of Agriculture—W. J. Blackie.

Animal Husbandry Officer—R. N. Sanders.

Mr. H. J. Hulek has been transferred from the Lands Department to take up the new post of Office Superintendent.

Mr. L. H. Dietrich has recently retired from the Service but has been appointed as Copra Inspector for the Copra Board and works in association with the Agricultural Department.

Mr. H. R. Surridge, A.R.C.S.I., B.Sc., who was appointed in 1929 as Agronomist to the Coconut Committee and who in 1931 joined the Department of Agriculture as Agricultural Officer, left the Colony in March for twelve months leave prior to retirement. In the course of his work with the Coconut Committee Mr. Surridge travelled widely in the coconut districts, and as an Agricultural Officer he was associated with the establishment of the Navuso Agricultural Station and with the organization of the field advisory extension services of the Department. During the war period he acted conjointly as officer in charge of Produce Inspection Services and from 1944 held the post of Acting Senior Agricultural Officer. The results of his work are recorded in numerous contributions made to this *Journal* covering a wide range of agricultural subjects.

—B.E.V.P.

FARMERS, GROW YOUR OWN FENCE POSTS!

Seedlings and cuttings of the following trees, which are recommended for planting on farms to provide fence posts and small timbers, are available for distribution—

Areca Palm, Teak, Yamane, Hydrocarpus, "Yaro", Kapok, Gliricidia, Albizzia and Mahogany. Prices: Cuttings 5s. per 100; Seedlings £2 10s. 0d. per 100.

REVIEW

AGRICULTURE IN MALAYA

After a break of five years the publication of the *Malayan Agricultural Journal* has been resumed under the Editorship of the Agricultural Economist; and the appearance of the first part of the post-war volume* is warmly welcomed.

The editorial records that "the Department was fortunate in being able to resume active work through its Field Branch shortly after the liberation of Malaya"—and pays a public tribute to the loyalty of the subordinate staff of the Department who during the occupation "maintained agricultural services and did their best to assist the small-holder with rice and foodcrop cultivation under most difficult conditions".

"The Departmental library and valuable records were preserved almost intact through the loyalty of the clerical staff."

Part one contains three original articles which have a very wide interest. Space prevents a detailed review of these articles which are briefly summarized as follows:—

"Vegetable production at Cameron Highlands"⁽¹⁾ is a general review of the production of temperate climate vegetables and a criticism of traditional Chinese methods of vegetable growing as brought into a totally different environment. The author contends that, observations having established that full soil fertility is retained by the use of large bulk dressings of compost (50 tons per acre per crop), it would be profitable for vegetable gardeners to devote the major portion of their holdings to the production of vegetable matter for use as fertilizer, either composted or as green manure.

In a brief review of essential food crop cultivation in Malaya, the Agricultural Economist⁽²⁾ deals with the 1945-46 production of rice, other essential food crops (as Tapioca, Sweet-potatoes, 'Sago, Pulses, Grains and Fruits) as well as of palm oil and kernels.

In the case of rice, the author states that as a result of war conditions, planted area of 789,640 acres has fallen by less than four per cent, whereas the yield of rice, 225,000 tons, shows a decrease of nearly 31 per cent. It is of interest to note that amongst the

factors responsible for this reduced yield are the neglect of irrigation systems during the period of occupation and the loss of high yielding strains selected prior to the war by the Department of Agriculture. The Japanese, it is stated, were more interested in efforts to introduce their own varieties with the result that a considerable loss of high-yielding seed was experienced, pure strains were mixed and lower yields harvested. They also introduced with Taiwan padi the serious "Blast" disease, and the depredations of wild pigs, squirrels and rats greatly increased during the years of occupation. The article records steps taken to improve the position so that the total area of padi for the ensuing season is expected to be 837,000 acres.

Planting of other essential food crops showed an increase over the 1940 figures due to the intensive planting of tapioca and sweet potato during the occupation, due partly to the considerable exodus from the towns into the country.

The extensive areas of pineapples were neglected during the Japanese occupation but new areas have been opened up and planted.

The palm oil industry suffered severely owing to loss of machinery but rapid progress has been made with rehabilitation and 36 estates representing 69,000 acres are in production.

The third article⁽³⁾ dealing with intensive gardening in a P.O.W. camp is a valuable account of work done to produce adequate supplies of green vegetables for several thousand prisoners in Changi camp. Very useful information is given on the manufacture of compost, the production of compost without flies and its application and cost. The author who was formerly Camp Compost Officer at Changi summarizes the results achieved as follows:—

"(1) An infertile and unproductive soil can be made to give high yields of 'greens' by incorporating compost made from kitchen waste.

*The *Malayan Agricultural Journal*, Vol. XXX, No. 1 January 1947, Dept. of Agric. Kuala Lumpur—Price 50 cents.

- (2) Compost can be produced in 45 days in the tropics by covering the heaps with a jacket ofalang†.
- (3) It can also be produced without flies, and at a cost of 40 man-hours per ton."

Another first-hand account of work accomplished under the most adverse conditions deals with biochemical work carried out in a P.O.W. camp which was full of patients, had a limited supply of drugs and medical equipment but no biochemical apparatus. This article cannot fail to be of interest to all readers(4).

The remainder of the space in this number is devoted to notes, comments and statistics comprising a valuable contribution to an understanding of the present position of agricultural industry in the Malayan Union.

Reference is made to the long-range plans of the Department which include the establishment of a Central Fruit Research

Station, the rehabilitation of rubber small-holdings with high-yielding clonal material, canning and food preservation, the expansion of the School of Agriculture and the livestock industry.

The development of these and other activities of the Department will no doubt be adequately recorded in future issues of the *Journal* under review, and these will be looked forward to by all readers concerned in any way with tropical agriculture.

—B.E.V.P.

[Readers who wish to peruse this article should apply to the Librarian, Department of Agriculture, Suva.—Ed.]

†*Imperata cylindrica*.

REFERENCES.

- (1) Lowe, B. A.—"Vegetable Production at Cameron Highlands" page 5.
- (2) Barnett, H. L.—"A Brief of Review of Essential Foodcrop Cultivation in Malaya".
- (3) Cooke, F. C.—"Intensive Gardening in a P.O.W. Camp" page 19.
- (4) Wilsham, R. G. H.—"Improvised Biochemical Work of a Prisoner of War" page 27.

SOUTH PACIFIC RESEARCH COUNCIL

Desiring to encourage and strengthen international co-operation in promoting the economic and social welfare and advancement of the peoples of non-self-governing territories in the South Pacific, the Governments of Australia, the French Republic, the Netherlands, New Zealand, the United Kingdom and the United States of America have established the South Pacific Commission with the following powers and function(1):—

- (a) to study, formulate and recommend measures for the development of, and where necessary the co-ordination of services affecting the economic and social rights and welfare of the inhabitants of the territories within the scope of the Commission, particularly in respect of agriculture (including animal husbandry), communications, transport, fisheries, forestry, industry, labour, marketing, production, trade and finance, public works, education, health, housing and social welfare;
- (b) to provide for and facilitate research in technical, scientific, economic and social fields in the territories within the scope of the Commission and to

ensure the maximum co-operation and co-ordination of the activities of research bodies;

- (c) to make recommendations for the co-ordination of local projects in any of the fields mentioned in the previous sub-paragraphs which have regional significance and for the provision of technological assistance from a wider field not otherwise available to a territorial administration;
- (d) to provide technical assistance, advice and information (including statistical and other material) for the participating Governments;
- (e) to promote co-operation with non-participating Governments and with non-governmental organizations of a public or quasi-public character having common interests in the area, in matters within the competence of the Commission;
- (f) to address inquiries to the participating Governments on matters within its competence;
- (g) to make recommendations with regard to the establishment and activities of auxiliary and subsidiary bodies.

In view of the special importance for the carrying out of the purposes of the Commission, a Research Council was established which shall serve as a standing advisory body auxiliary to the Commission. Its functions are:—

- (a) to maintain a continuous survey of research needs in the territories within the scope of the Commission and to make recommendations to the Commission on research to be undertaken;
- (b) to arrange, with the assistance of the Secretary-General, for the carrying out of the research studies approved by the Commission, using existing institutions where appropriate and feasible;
- (c) to co-ordinate the research activities of other bodies working within the field of the Commission's activities and, where possible, to avail itself of the assistance of such bodies;
- (d) to appoint technical standing research Committees to consider problems in particular fields of research;
- (e) to appoint, with the approval of the Commission *ad hoc* research committees to deal with special problems;
- (f) to make to each session of the Commission a report of its activities.

Included in projects related to agriculture and recommended by the South Seas Conference for early consideration were the following:—

AGRICULTURE.

- (a) biochemical investigations in connexion with animal nutrition;
- (b) systematic botanical investigations;
- (c) research into plant pests and diseases research;
- (d) a biological survey;
- (e) a study of the relationship between plants and their environment including soils and climate.

ECONOMICS.

- (a) an economic survey to include native industries, native fisheries, native trading systems and native co-operative movements and organizations;
- (b) a study of the mechanisation of production and of suitable schemes for the organization of uniform grading,

packing, pooling and marketing of primary products such as copra;

- (c) the development of schemes for the introduction to and distribution in the territories of potentially useful species, varieties, breeds or strains of plants and animals;
- (d) the taking of all possible steps, within the scope of the functions of the Commission, to ensure adequate shipping services within the area.

FISHERIES.

Fisheries research, including surveys and the testing of methods of catching and of processing fish and other marine products with the special aim of improving the nutrition of the local inhabitants.

FORESTRY.

Surveys of or research in:—

- (a) forest resources in regard to areas, commercial timbers and other forest products;
- (b) forest management including utilization of forests and forest products;
- (c) technology of wood and other forest products;
- (d) the relationship between forests and water conservation and soil conservation.

Readers will remember that His Excellency, the Governor, Sir Alexander Grantham, K.C.M.G., when making his address to Legislative Council in March, referred to the Commission as follows⁽²⁾:—

"I am sure that Honourable Members will agree with me that the establishment of the South Pacific Commission will bring to the peoples of Fiji, and the other island territories, considerable practical benefits. And it is practical results that we shall look for. We must however not be impatient, and expect all our economic and social welfare problems to be solved within a year or two of the Commission coming into being. Nor must we relax our own efforts in endeavouring to improve the lot of our people. The Commission will help us to do better what we are already striving to do."

—M.G.M.

REFERENCES.

- (1) 1947. Legislative Council, Fiji. Council Paper No. 7.
- (2) 1947. Legislative Council, Fiji. Council Paper No. 9.